Tutorial
H-1000-5305-01-A

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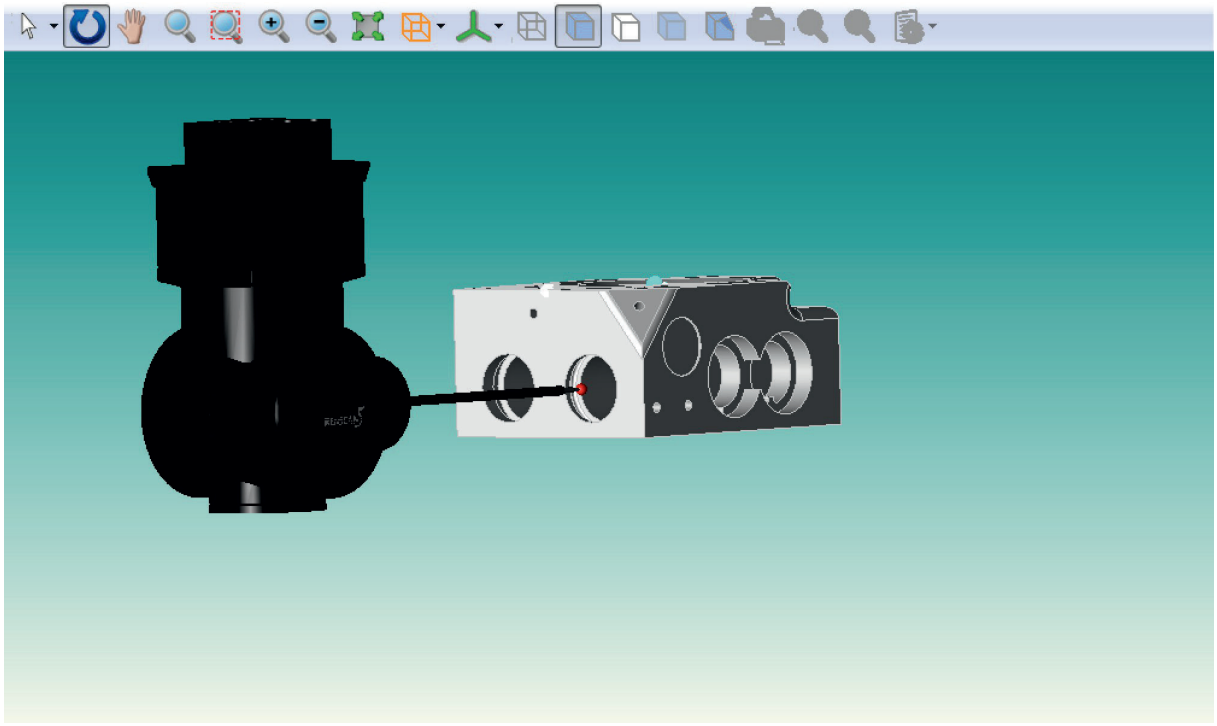
Introduction to 5-axis measuring and movement techniques (CAD)



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Introduction to 5-axis measuring and movement techniques (CAD)

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Contents

1 Introduction to 5-axis measuring and movement techniques (CAD)

1.1 Tutorial pre-requisites

- The student should have a sound understanding of component alignment techniques
- The student should have completed the 'Further CNC measurement functions' tutorial

1.2 Tutorial objectives

- To introduce the concepts of high-speed 5-axis movement around a part and measurement whilst moving up to all five axes
- An introduction to the flexibility of 5-axis programming with respect to part orientation

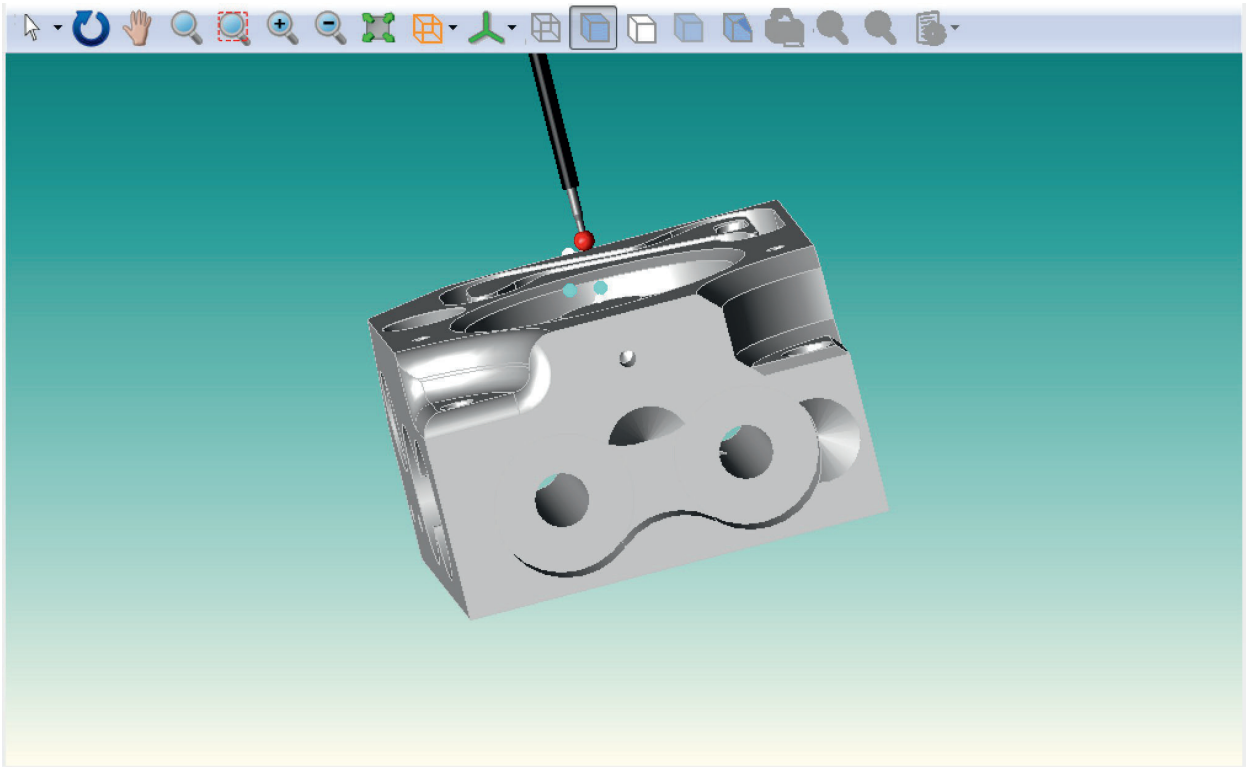
2 Introduction

In this tutorial the student will consider the use of 5-axis movement and measurement methods and the benefits of 5-axis control when writing inspection programs.

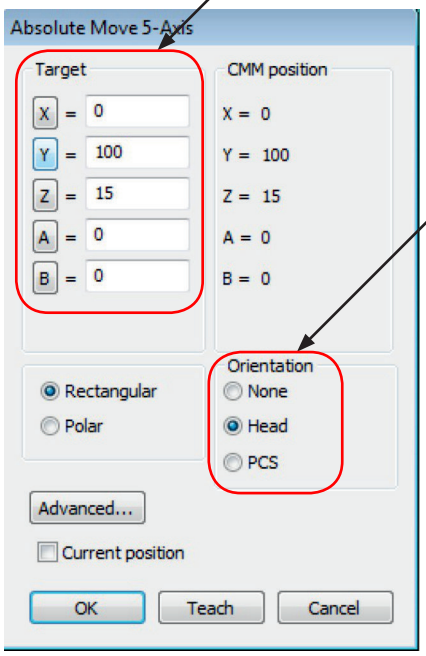
3 Measuring a bore using touch points

Before commencing measurement in this tutorial it is assumed that a precise alignment of the training block has been created using fully automated measurement techniques gathering data from the CAD model.

Position the probe at a suitable distance above the centre of the training block:



Create a GOTO move either by clicking ‘Move’ then absolute or by pressing ‘Take point’ on the MCU. Edit this to give the desired position.

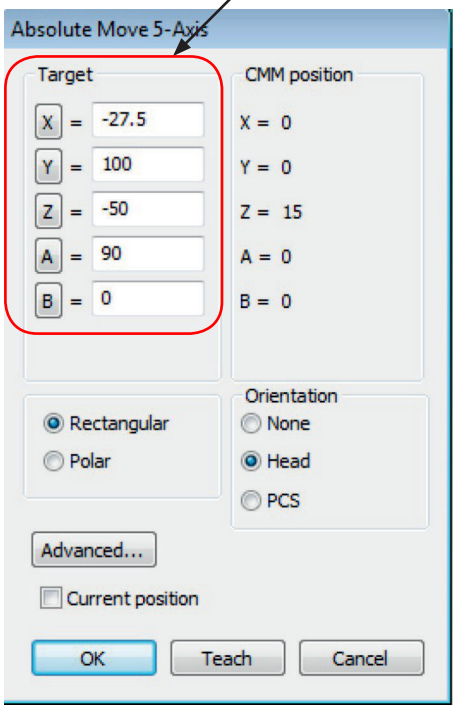


Ensure ‘Orientation’ is set to ‘Head’.

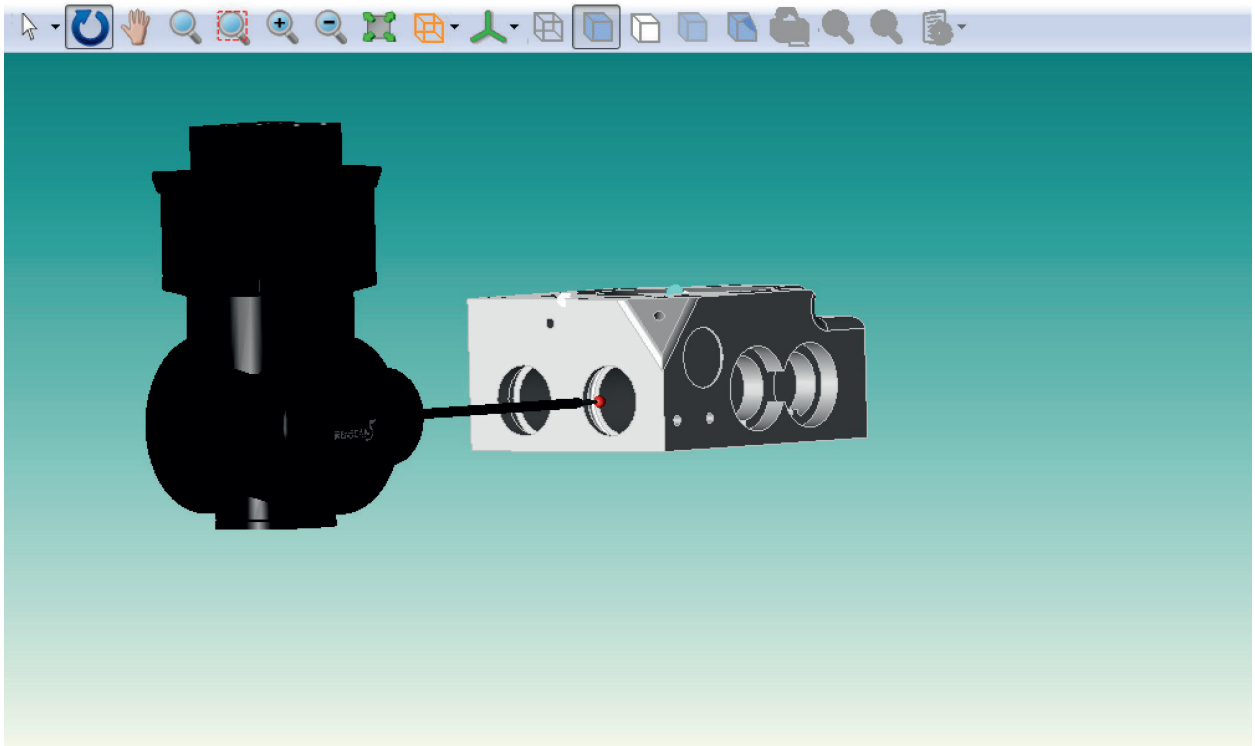
This move will position the probe head ready for a move down to a position in front of the bore to be measured.

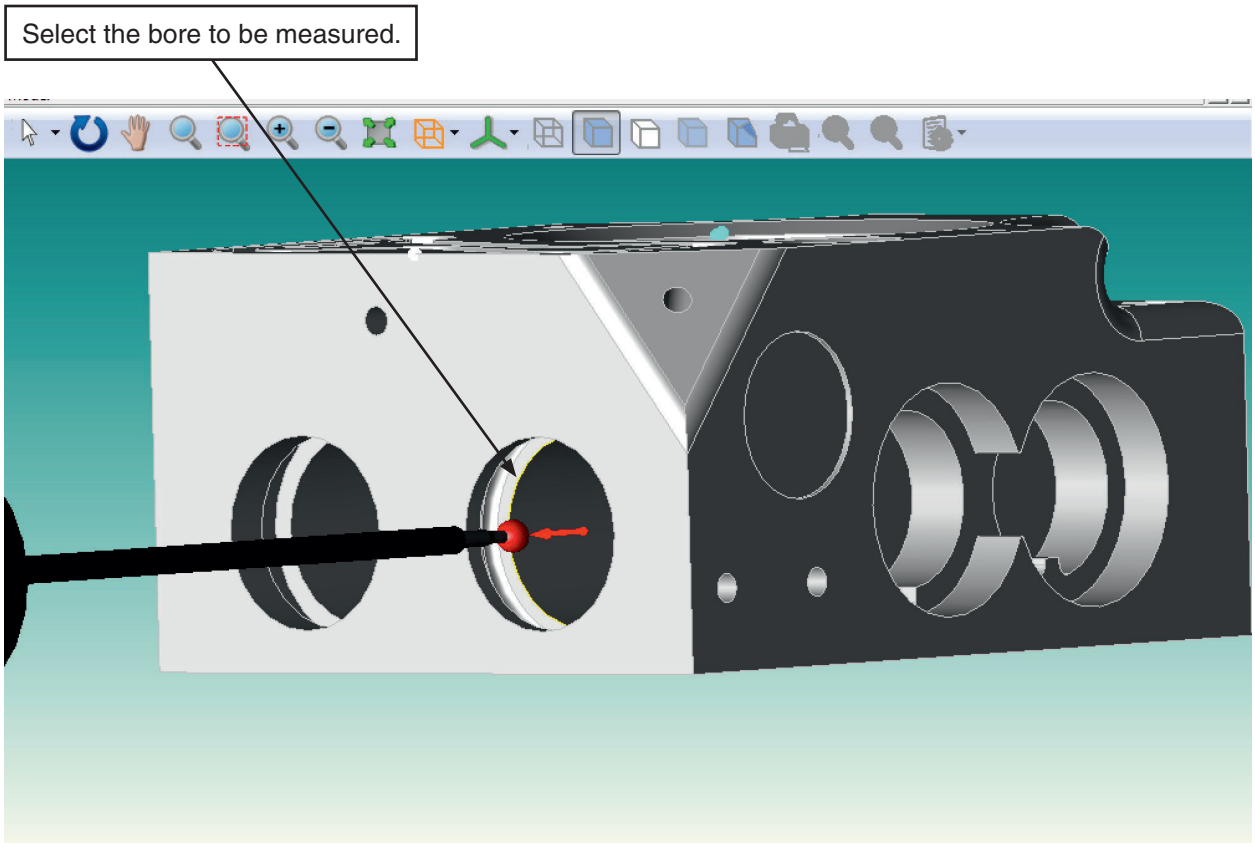
GUIDANCE NOTE: Care must be taken when these GOTO moves include head rotation to ensure that the head rotates in a direction that will not cause a collision with the component being measured. In the case of 180 degree rotations this can be achieved by carrying out a partial rotation at the first GOTO point (i.e. rotate to 90 degrees before continuing to 180 degrees).

Next use a GOTO move to position the probe in the bore (as shown in the screen shot below).



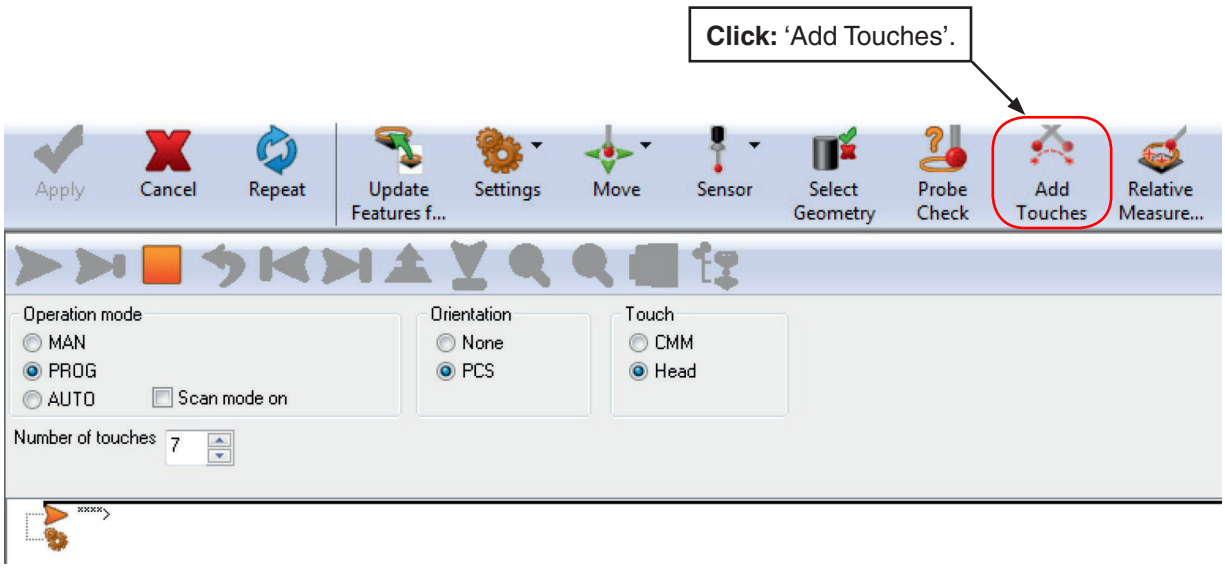
This move will position the probe head ready to measure the bore on the end face of the block.

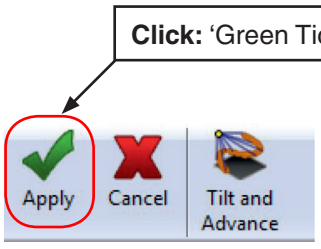




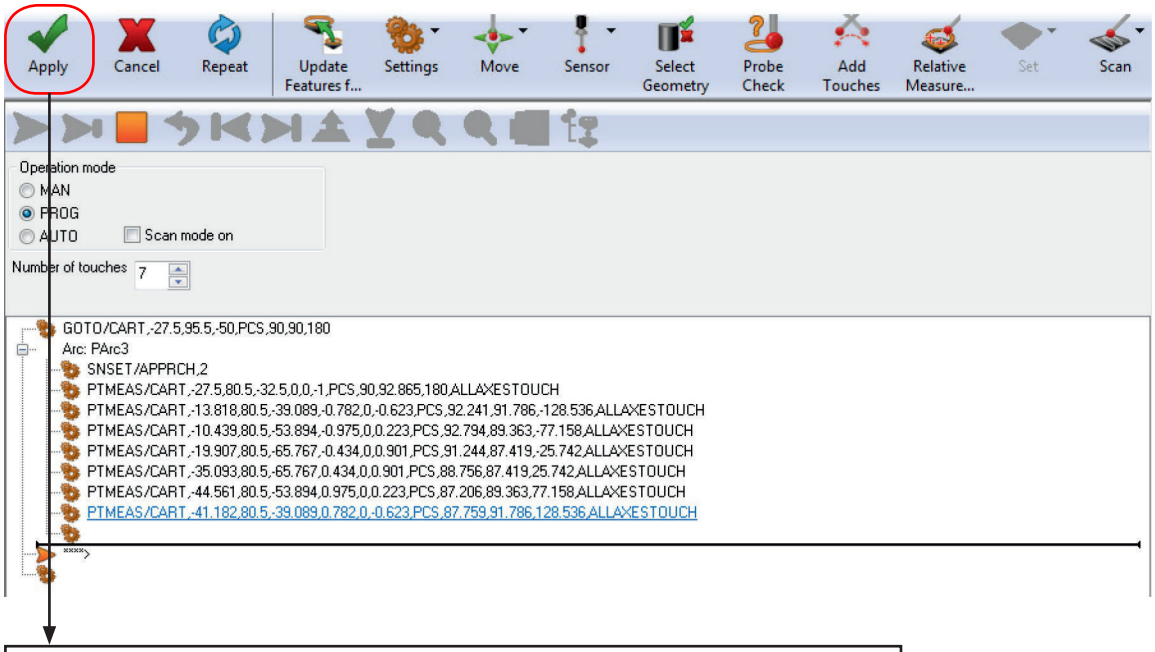
Ensure that the ‘PROG’ function is selected and enter the desired number of points to be measured.

Also make sure that ‘PCS’ and ‘Head’ modes are selected. The reasons for this will be explained later.





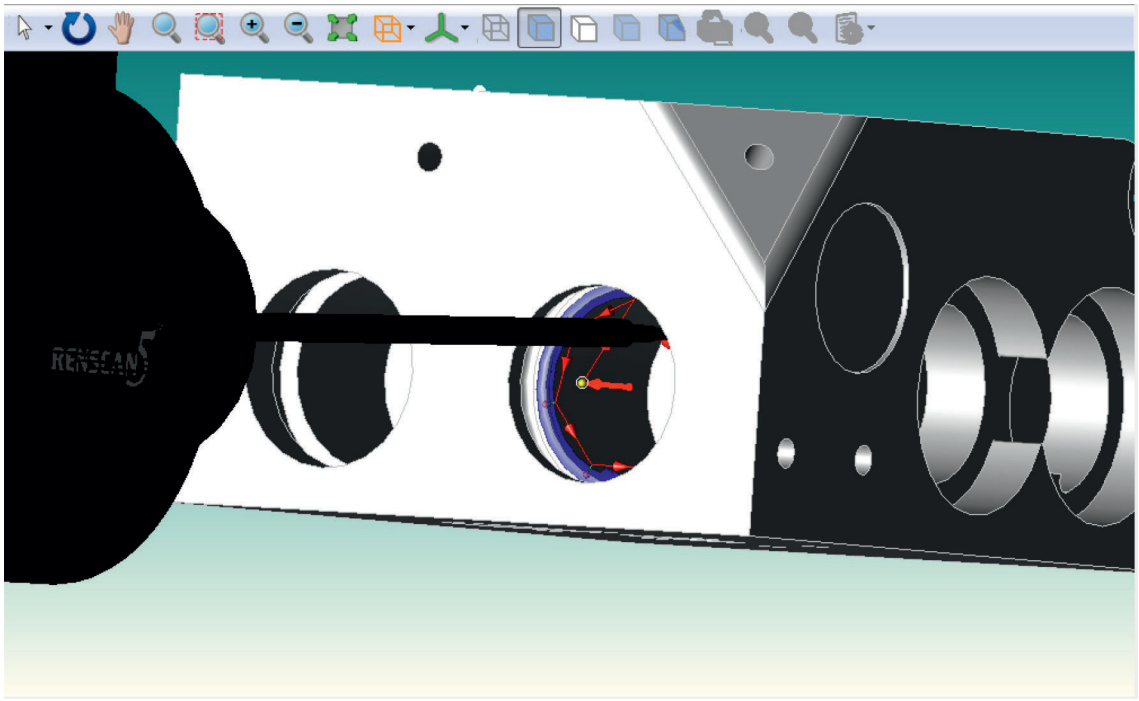
The following screen will appear. The 'Tilt and Advance' function will be covered in a separate tutorial.



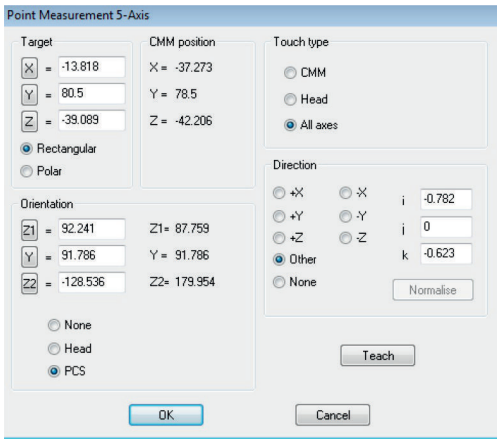
Click: 'Green Tick'.

The hole will be automatically measured following the path shown below.

The DMIS code for this measurement is shown at the bottom of the page.



```
000185  $$<MEAS_CIRCLE name = "CIR006">
000186  MODE/PROG,MAN
000187  F(CIR006)=FEAT/CIRCLE,INNER,CART,-27.5,80.5,-50,0,1,0,35
000188  MEAS/CIRCLE,F(CIR006),7
000189  PTMEAS/CART,-45,80.5,-50,1,0,0,PCS,87.135,90,90,ALLAXESTOUCH
000190  PTMEAS/CART,-38.411,80.5,-63.682,0.623,0,0.782,PCS,88.213,87.76,38.606,ALLAXESTOUCH
000191  PTMEAS/CART,-23.606,80.5,-67.061,-0.223,0,0.975,PCS,90.638,87.206,-12.873,ALLAXESTOUCH
000192  PTMEAS/CART,-11.733,80.5,-57.593,-0.901,0,0.434,PCS,92.582,88.757,-64.314,ALLAXESTOUCH
000193  PTMEAS/CART,-11.733,80.5,-42.407,-0.901,0,-0.434,PCS,92.582,91.243,-115.686,ALLAXESTOUCH
000194  PTMEAS/CART,-23.606,80.5,-32.939,-0.223,0,-0.975,PCS,90.638,92.794,-167.127,ALLAXESTOUCH
000195  PTMEAS/CART,-38.411,80.5,-36.318,0.623,0,-0.782,PCS,88.213,92.24,141.394,ALLAXESTOUCH
000196  ENDMES
000197  $$<\MEAS_CIRCLE = CIR006>
000198
```

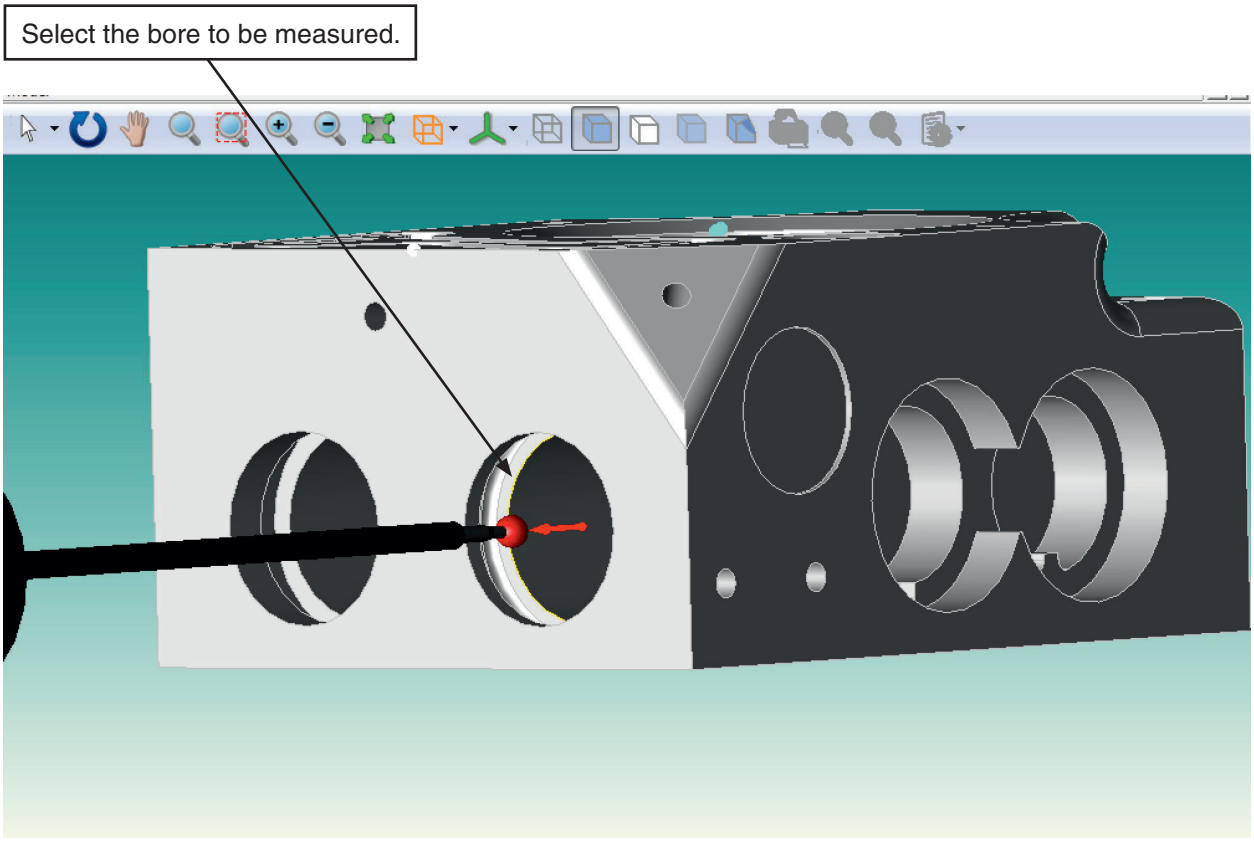


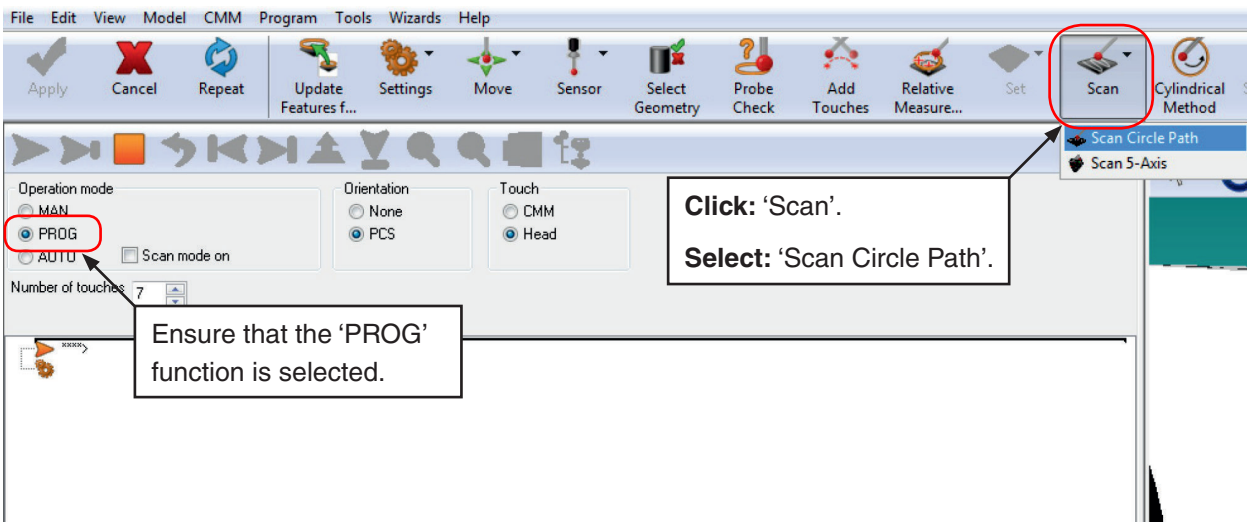
View the measurement data, as displayed in the box on the left, by double clicking on any of the 'PTMEAS' lines. This data can be edited to modify parameters such as target co-ordinates, head orientation, touch type and direction.

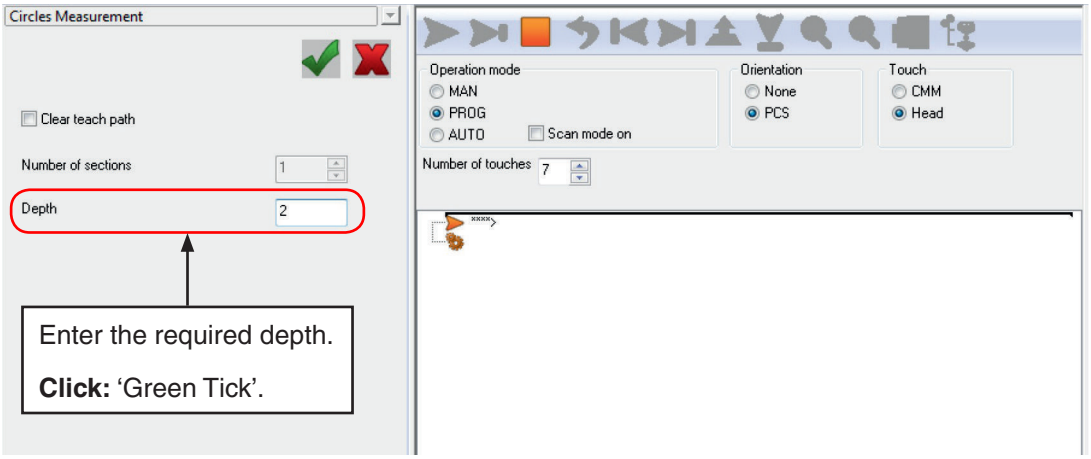
4 Measuring a bore using scanning techniques

Scanning techniques are often favoured over touch points because much more data is collected over the entire feature, reducing the chance of anomalous points (such as specks of dirt) affecting overall results.

To measure the same feature on the training block:

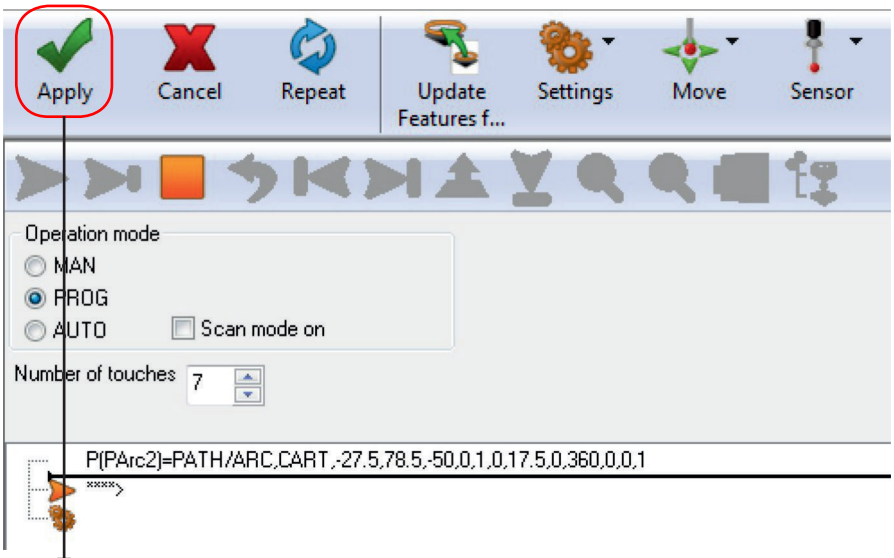






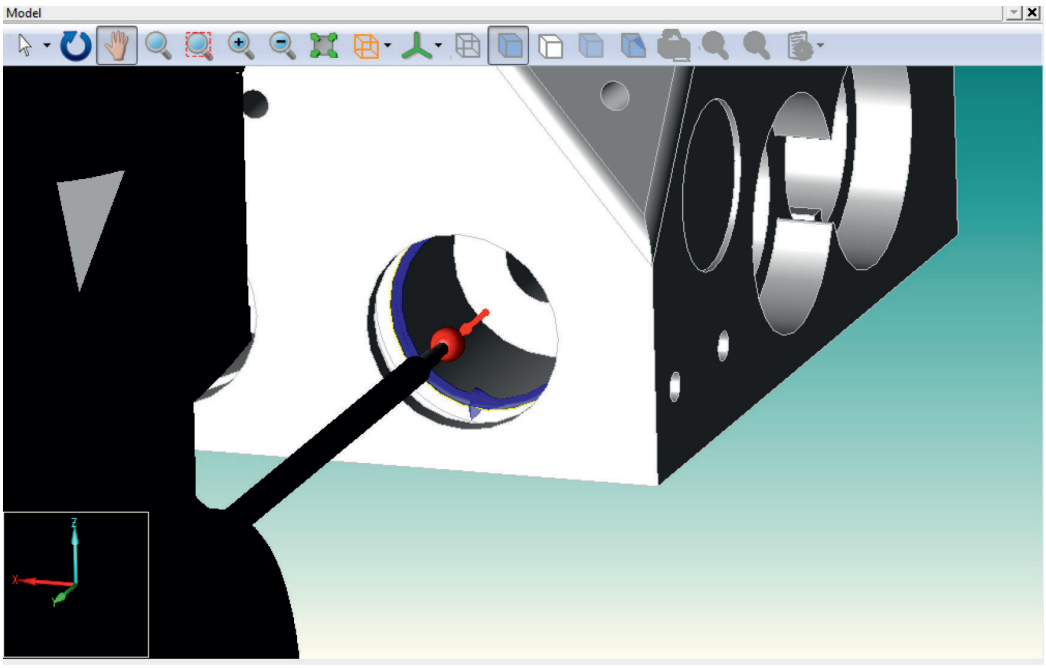
Enter the required depth.

Click: 'Green Tick'.



Click: 'Green Tick'.

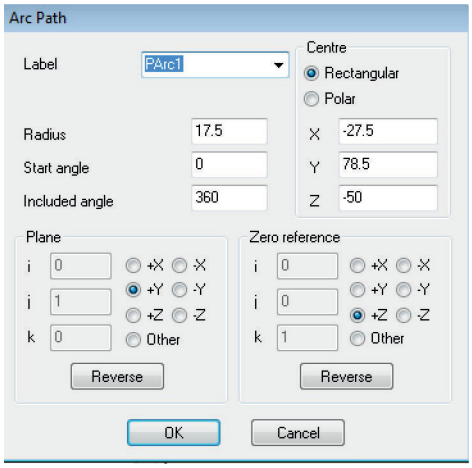
The hole will be automatically measured.



This is the code produced in the program for the scanned bore:

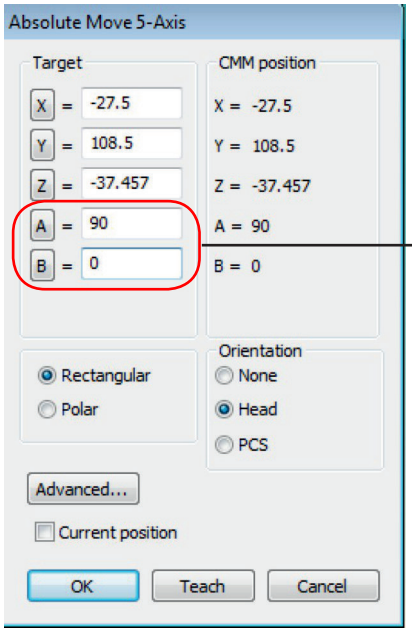
```
000171
000172  $$<MEAS_CIRCLE name = "CIR005">
000173  P(PArc1)=PATH/ARC,CART,-27.5,78.5,-50,0,1,0,17.5,0,360,0,0,1
000174  MODE/PROG,MAN
000175  F(CIR005)=FEAT/CIRCLE,INNER,CART,-27.5,80.5,-50,0,1,0,35
000176  MEAS/CIRCLE,F(CIR005),7
000177  PAMEAS/DISTANCE,0.5,SCNVEL,MMPS,100,P(PArc1),0,0,-1
000178  ENDMES
000179  $$<\MEAS_CIRCLE = CIR005>
000180
```

GUIDANCE NOTE: If the path / arc line above is double clicked the arc path data shown in the box on the left is displayed. This data can be edited to modify the path parameters shown. These parameters and the reasons / needs for modifications will be discussed in subsequent tutorials.



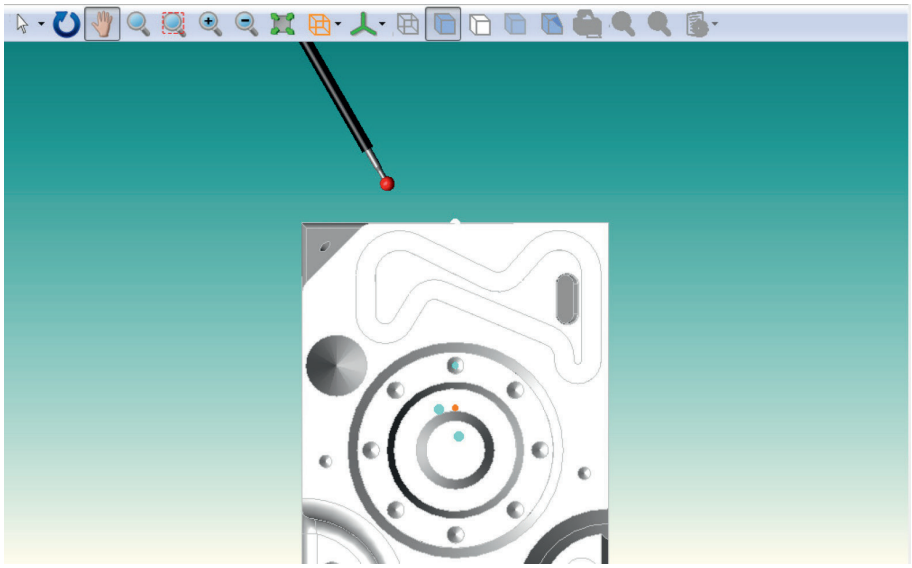
5 Explanation of head and PCS movement methods

When programming it is important to understand the head and PCS functions.

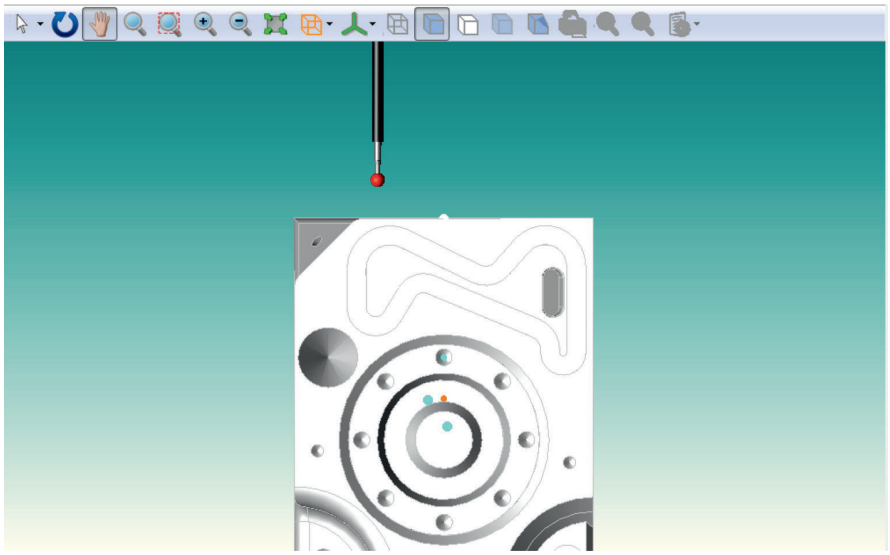


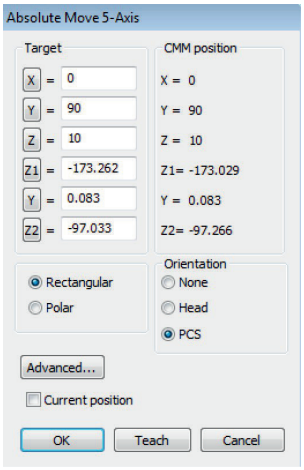
When using the head mode function, program a move with probe head movement defined in the normal A and B orientations. These head moves will be made with no consideration of any co-ordinate system alignments selected. For example; this move will send the probe to the position detailed, with the head set at an inclined angle of 90 degrees and a rotation of zero.

The move detailed on the previous page will result in a suitable move providing that the component is generally in line with the machine co-ordinate system. If, however, the component is set on the machine at an angle, the situation shown below will occur. This is not acceptable for measurement purposes.



In this case, if the move was made using the PCS (part co-ordinate system) mode then the situation shown below will occur. When measuring and positioning in PCS mode the probe will always be orientated relative to the part co-ordinate system alignment.





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